COMPARISON OF PRE- AND POST-INTERVENTION LEVELS OF PHYSICAL ACTIVITY AMONG SEDENTARY FINNISH MOTHERS

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ABSTRACT

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The 1990's marked a shift in the academic understanding of health-enhancing physical activity that was different from the exercise-based physical fitness paradigm that ruled public health policy at the time. Since then, lifestyle physical activity has been incorporated into physical activity recommendations worldwide and recognized medically and culturally for its impact on many chronic health conditions. Lifestyle physical activity interventions (LPAI) increase moderate-intensity physical activity and decrease sedentarism. Interventions are mostly developed for big population clusters, like elderly people, children and adolescents, and people with chronic deseases, thus there is a knowledge gap concerning other population groups. In 1998 Dunn, Anderson and Jakicic called for testing LPAI in specific populations, such as mothers with newborns, in order to improve interventions targeting those populations.

This study examines if there is any change in physical activity and sedentary behavior for two groups of stay-at-home (n = 14) and working Finnish mothers (n = 8) after a one year, group based LPAI. The LPAI was conducted by LIKES Foundation of Sport and Health Sciences. The LPAI was a small-group discussion based intervention that covered themes such as time use, social relationships, goal-setting, and barriers to physical activity. The structure of the LPAI was a once-per-month session that began and ended with a round of discussion, with a break for walking and socializing in the middle. Participant preferences for intervention structure and topics was solicited monthly and incorporated into the design.

All mothers in the study but one had returned to work by the post measurement; therefore transitions to work and to motherhood are both well represented in this group. Measures of physical activity were taken via Harmonized European Time Use Survey and ActiGraph GT3X and GT1M accelerometers. The time use surveys were coded using MET values, assigned according to Ainsworth's (2000) compendium of physical activity. Non-parametric Wilcoxon signed rank test was used to compare values within group and a Kruskal-Wallis test with a *post hoc* Mann-Whitney U test was used to compare values between location and number of children. The aim of this study was to describe the change in physical activity among the intervention groups after a one year LPAI.

Overall there was no increase in physical activity detected. Differences in physical activity at baseline between intervention groups were revealed: working mothers were significantly less active than stay-at-home mothers prior to intervention. The fact that levels of physical activity did not decrease, as is typical during the life transitions to motherhood and returning to work, is promising for future interventions and research in LPAI.

Keywords: sedentary behavior, mothers of newborns, lifestyle physical activity, group intervention

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1. INTRODUCTION

Physical activity (PA) is important for physical reasons as well as for psychological well-being (Biddle & Mutrie, 2008). Studies show PA correlates with health factors such as improvement in heart disease, cancer and stroke risk as well as reduced symptoms and increased control of type 2 diabetes (Biddle & Mutrie, 2008).

Aside from the above mentioned health benefits of PA, female specific effects of PA should be addressed as well. Recent research from Australia showed PA positively influenced breast cancer recovery (McDonough, Sabiston, & Ullrich-French, 2011). Menopausal women who engage in PA are better able to cope with physical side effects of changing hormone levels (Heath, 2009). PA is particularly important for children and postpartum mothers in terms of physical health as well as various psychosocial variables and treatment of postpartum depression (Devine, Bove, & Olson, 2000; Zourladani, Tsaloglidou, & Tzetzis, 2011; Pereira et al., 2007). Physically active mothers are more likely to continue breastfeeding (Zourladani, Tsaloglidou, & Tzetzis, 2011). Interestingly, recall of labor and delivery experience in the Zourlandani, Tsaloglidou, and Tzetzis (2011) study was positively affected by PA undertaken weeks after the actual event regardless of how the labor and delivery had proceeded. In the same study, PA was shown to improve partner relationship postpartum.

Females in general, and mothers in particular, are shown across the literature to sustain lower PA levels than men (Hull et al., 2010; Devine, Bove, & Olson, 2000; Bell & Lee, 2006; King, Kiernan, Ahn, & Wilcox, 1998; Malina, 2001). In order to address this lack of PA, it is important to focus on developing specific interventions that promote well-being and PA among women. Current exercise-focused interventions are mostly designed for men and do not tend to address barriers specific to female exercisers such as concern over self-image, lack of self-efficacy, and lack of time, all of which reduce adherence and exercise maintenance (Devine, Bove, & Olson, 2000). In fact, mothers with newborns who obtained their PA primarily by exercise lose much more of their previous levels of PA postpartum compared to mothers who obtained their PA via lifestyle physical activity (LPA)(Devine, Bove, & Olson, 2000). Thus the LPA paradigm may prove more practical when targeting mothers to promote PA. Lifestyle physical activity interventions (LPAI) have been

shown to promote efficacy, require less time, and be easily adjusted for preferred activities (Dunn, Anderson & Jakicic, 1998). LPAI can create healthier communities and lower the barriers to PA both internally via education, counseling, and social support and externally by providing safe areas to commute and play, generate an out-and-about mentality, link facilities to neighborhoods within walking distance, and generate a sense of place (Heath, 2009).

The aim of the current research is to describe the change in level of PA after a group of Finnish mothers participate in a one year LPAI. The research is carried out under the supervision of Taru Lintunen within the project of LIKES (Foundation for Sport and Health Sciences, Jyvaskyla, Finland) with senior researcher Esa Rovio, and in collaboration with Pinja E. Laitinen.

Before presenting the current research, it is important to define key concepts such as PA, inactivity, exercise and sedentary behavior as understanding of these concepts fluctuates. Furthermore motivation and determinants of PA must be clarified conceptually together with amotivation. The perceived barriers preventing participation in PA will also be briefly reviewed.

1.1. Definitions of physical activity

The problem of people being physically inactive is quite acute (Department of Health, 2010; Biddle & Mutrie, 2001; Dunn et al., 1998). Physically inactive lifestyles and sedentary behaviors have been proven as risk factors for health among all ages, genders, ethnicities and socioeconomic groups (Van Der Horst, Paw, Twisk, & Van Mechelen, 2007; Sallis & Owen, 1999). It is of utter importance to develop physically active behaviors to avoid major health risks and improve general well-being (Blair, Kohl, Gordon, & Paffenbarger, 1992).

First it is important to define PA. Why is PA important? What is physical inactivity respectively? Why is inactivity undesirable? What is the difference between physically inactive and sedentary behavior, if there is any? These questions are answered by giving definitions of the main terms and thus framing the general concepts used in the present study.

Physical activity. We will start with PA as it is a key definition before proceeding to narrow down to the more specific terms. PA is usually mixed up with the terms exercise and physical fitness (Caspersen, Powell, & Christenson, 1985). PA

is defined by Caspersen et al. (1985) as “any bodily movement produced by skeletal muscles that results in energy expenditure” (p. 126). This definition includes a broad spectrum of various activities like household chores, occupational activities, sports, and others. All people are physically active at an organismic level, but this basal PA is differentiated from Caspersen’s PA by the level of energy expended. In this study, we will be addressing sufficient and insufficient levels of PA from a health perspective (Tudor-Locke & Myers, 2001).

Exercise and Physical Fitness. It is important to separate exercise and PA which, as a broad category, includes the simplest movements like writing (Caspersen et al., 1985). Taylor (1983) writes that the terms PA and exercise have been considered to have the same meaning and that confusion still exists today. However, there are also significant differences between them. As was mentioned above, PA is a broad category containing basically any movement that requires energy expenditure, whereas exercise is an organized set of movements, typically regular and planned. In other words, PA is not necessarily directly aimed at developing muscular strength or losing body weight – it is often done to reach other goals. Exercise, on the other hand, is a purposeful activity and is often a process aimed at developing physical fitness, which is a quality defined as one of the outcomes of PA and exercise. Physical fitness is tightly connected with health and well-being. Health does not only mean the absence of disease but also the maintenance of well-being (US Department of Health and Human Services, 2008; Bouchard & Shephard, 1994). We will not go into too much detail here as this study focuses on the PA aspects of health.

Sedentary behavior. The term sedentary behavior is used interchangeably with the common terms sedentarism, sedentary, and physical inactivity (Tudor-Locke & Myers, 2001). An inactive individual was defined as a person who does not “meet either the traditional fitness-exercise guidelines or the more recent public health guidelines” (Tudor-Locke & Myers, 2001, p 92). However, in recent literature the definition of sedentary behavior became more clearly distinct from the insufficiency of PA (Marshall & Welk, 2008). Generally speaking sedentary behaviors are those behaviors that mostly consist of sitting or lying down with very low energy expenditure (Department of Health, 2010). It also may be defined using metabolic equivalent scores (METs): Pate, O’Neill and Lobello (2008) define sedentary behavior as “activities that do not increase energy expenditure substantially above the

resting level and includes activities such as sleeping, sitting, lying down, and watching television, and other forms of screen-based entertainment" (p.174). In other words, sedentary behaviors are those with the level of energy expenditure around 1.0 – 1.5 of METs, above 1.5 METs starts the light PA level (slow walking, some house chores etc.), but these numbers vary from research to research (Department of Health, 2010).

Biddle et al. (2010, 2004) recommended a specific understanding of sedentary behavior, rather than just as absence of PA. In an example described by Tudor-Locke and Myers (2001) a student can be going jogging regularly but also spending much time working on the computer, reading, studying, watching television etc. She is performing PA along with typical sedentary behaviors but cannot actually be considered a "sedentary individual" generally speaking. Consequently, sedentary behavior is likely to coexist with PA (Owen, Leslie, Salmon, & Fotheringham, 2000). Sedentary behavior can even reduce the positive effect of PA on a person (Salmon, Bauman, Crawford, Timperio, & Owen, 2000). Thus we can make a conclusion that sedentarism is not simply the absence of PA, but a separate concept in and of itself. These phenomena have different determinants and do not represent two poles of one theoretical continuum (Biddle et. al, 2002).

The majority of research on sedentary behavior has been connected with television viewing and conducted mostly among children or adolescents (Sidney, Sternfeld, Haskell, Jacobs, Chesney, & Hulley, 1996; Department of Health, 2010). The findings did not support the hypothesis about negative connections between sedentary behaviors and PA. The few studies on adults' sedentarism, however, showed the presence of a negative connection between television viewing and PA (Epstein & Roemmich, 2001; Gordon-Larsen, Nelson, & Popkin, 2004). It is also important to note that childhood is the most active time of a person's life, and has been studied the most, but with increasing age a person's level of PA decreases. Thus it is important to study the adult population and to establish and maintain the active lifestyle throughout adolescence and young adulthood to prevent the development of diseases in the later stages of life (Malina, 2001).

Screen-related behavior, using motorized transportation means, sitting (to work, study, read etc.) and lying down are distinguished as types of sedentary

behaviors. They occur during leisure and working (studying) time, at home and during transport (Department of Health, 2010).

According to the latest findings (Department of Health, 2010) approximately two-thirds of adults self-reported to be involved in screen-related behaviors for more than two hours per day. From these reports we can also see that those adults spend about five hours sitting during working or studying time and from three to four hours sitting during leisure time. This data is confirmed by objective measures, which also show that these adults spent 50-60% of their time awake sitting. These numbers show us an urgent need to develop interventions targeted on significantly decreasing sedentary behaviors and increasing time spent being physically active.

Lifestyle physical activity. LPA is a crucial definition for this research as we analyze the PA levels of mothers who participate in an LPAI. Dunn et al. (1998, p.338) defined LPAI as "increasing moderate intensity activity while attempting to take into account individual, cultural, and environmental differences." LPA is defined as, "the daily accumulation of at least 30 minutes of self-selected activities, which includes all leisure, occupational, or household activities that are at least moderate to vigorous in their intensity and could be planned or unplanned activities that are a part of everyday life." (Dunn et al., 1998, p. 339)

In the present research we will be addressing the above concepts in two broad categories. On the one hand, sedentary behaviors and insufficient PA and on the other, PA and exercise. In the next section we will review why physical inactivity and sedentary behaviors can have a negative impact on health, why it is important to be physically active, and what can possibly stand in the way of leading an active lifestyle.

2. PHYSICAL ACTIVITY OF WOMEN AND MOTHERS

2.1. Motivation, barriers, and determinants of physical activity

Large amounts of research reveal the benefits of a physically active lifestyle. Among the health benefits of PA the following are usually described: strong preventative (or protective) effect on coronary heart disease, all-cause mortality, hypertension, obesity, colon and some other types of cancer, non-insulin-dependent diabetes mellitus, osteoporosis and functional capacity (Blair et al., 1992). It has also been proven that PA has an impact on mental health and psychological well-being, in particular, there is a beneficial effect on: anxiety and stress reactivity, mild or moderate depression, self-perceptions, mood and general psychological well-being, cognitive function and psychological adjustment (Biddle, 1995a; Biddle, Fox, & Boutcher, 2000). Moreover, PA may have connections with other health behaviors, not included in the two categories mentioned above: a negative relationship between PA and smoking, caloric intake of non-obese people increases with an escalation of PA, more active groups tend to have healthier nutritional habits, and a small positive connection was found between PA and some preventative health behaviors, such as wearing a seat-belt while driving (Wankel & Sefton, 1994).

According to the facts mentioned above physically inactive and sedentary lifestyles can lead to certain health risks, such as chronic diseases, type II diabetes, stroke, heart disease, obesity, some forms of cancer and even premature death (Department of Health, 2010; Rhodes & Dean, 2007).

The benefits of moderate PA as well as negative consequences of insufficient PA and sedentarism are obvious and many guidelines are issued, but still a large percentage of the world population remains physically inactive (Roth, Wiebe, Fillingim, & Shay, 1989; Canadian Fitness and Lifestyle Research Institute, 2002). This situation encourages researchers to search for other factors that influence participation or non-participation in physical activities. One of the main factors that effects involvement in PA is motivation: why are people physically active, what makes them exercise? Answering these questions helps to clarify what can be done to motivate physically inactive people to become active.

First it is necessary to define the term motivation. Motivation can generally be considered a behavioral disposition or orientation based on people’s personal goals,

social perception, and interpretation of the environmental characteristics and situation (Biddle & Mutrie, 2001). According to Maehr and Braskamp (1986) motivation is reflected in five behavioral patterns: direction, persistence, continuing motivation, intensity and performance.

There are numerous theories of motivation for PA. The main focus of this work is self-determination theory, because this framework defines not only motivation for PA but explains the phenomenon of non-participation in PA as well. The significant concept of amotivation is also considered within this theory, which is important for the research aims.

According to self-determination theory (Deci and Ryan, 1985) motivated behavior is aimed at satisfying three basic needs: for competence, autonomy, and relatedness. The authors also operate with three basic types of motivation: extrinsic motivation (directed by external rewards), intrinsic motivation (directed by the sake of activity itself with no external rewards) and amotivation. Amotivation is regarded as "a lack of intentionality and thus the relative absence of motivation" (Vlachopoulos & Gigoudi, 2008, p. 317). Pelletier, Dion, Tuson, and Green-Demers (1999) have considered amotivation a multidimensional concept. There are four types of amotivational beliefs marked out (Pelletier et al., 1999; Vlachopoulos & Gigoudi, 2008):

1. Global helplessness beliefs or capacity beliefs are defined as perceived lack of resources (physical or psychological) to cope with or perform the task.
2. Strategy beliefs or outcome beliefs are operationalized as expectations that behavior would not lead to certain benefits or effects.
3. Value beliefs refer to how much the activity is valued by the person.
4. Effort beliefs reflect the perception of one's own lack of desire to apply effort or maintain the behavior.

The phenomenon of amotivation has mostly been studied in the context of sport psychology as a factor for dropout among competitive athletes as well as nonattendance, boredom and low involvement of children and adolescents in school PE lessons (Pelletier, Fortier, Vallerand, & Cury, 2002; Ntoumanis, Pensgaard, Martin, & Pipe, 2004). Vlachopoulos and Gigoudi (2008) studied amotivation toward exercise among elderly inactive individuals. Although the concept is quite clearly

defined, future research is needed on the overall effect of amotivation on PA to provide guidelines for proper interventions.

Amotivation may not explain why the majority of physically inactive individuals do not exercise or why they cease participation, therefore other factors should be considered. Many people are not physically active due to perceived barriers or impediments that prevent them from exercising or maintaining this behavior (Sallis et al., 1992). There are five main types of such barriers that have been suggested (Biddle & Mutrie, 2001)

1. physical (injury/disability);
2. emotional;
3. motivational;
4. lack of time;
5. unavailability of sport facilities.

The United States Department of Health and Human Services (USDHHS, 2000) reported three main types of barriers to PA among adults. These included the lack of time, unavailability of convenient facilities, and lack of safe environment where individuals could practice. The time factor was considered more as an excuse and not an actual barrier towards exercising. Seefeldt, Malina and Clark (2002) then suggested yet another classification of possible barriers to PA. In addition to physical health factors they considered old age, socioeconomic status, geography, and social and physical environment to be the most influential factors that prevent individuals from exercising. These are external barriers to exercising.

In general, researchers highlight the following among the most significant barriers to exercising (Sallis et al., 1992): lack of time, the inconvenience of exercising, not enough self-motivation, lack of enjoyment while exercising, low self-efficacy, fear of injury, failing to adhere, lack of social support and lack of facilities.

A study by Zunft at al. (1999) showed the perceived barriers among the European population. In the course of the current research it is important to know if there is anything specific to the Finnish population in this aspect. The highest percentage loads among Finnish population were on the barriers such as no energy (19%), work or study obligations (16%), poor health (14%), not the sporty type (12%), looking after children/ elderly (10%), no need to exercise (6%) and too old (3%). Thirty percent were assigned to other reasons.

Another large study by Makinen, Borodulin, Laatikainen, Fogelholm, and Prattala (2009) showed that commuting PA levels lowered in recent years but leisure time PA increased (years 1978-2002). Also there is an indication that low income is connected with physical inactivity.

In discussing the possible barriers to participation in PA the general factors that affect participation – the determinants of PA – should be mentioned. The term determinant is often used in scientific literature in the same meaning as antecedents and correlates (Biddle & Mutrie, 2001). They can be divided into two major groups (Seefeldt et al., 2002):

- Immutable determinants (constant, unchangeable): genotype, age, gender, race or ethnicity.
- Modifiable determinants (the ones that can be changed or influenced): personal characteristics, community settings, social support, environmental circumstances, economic status, occupation, physical disability, education and opportunities for healthcare.

Another possible categorization, suggested by Dishman, Sallis, and Orenstein (1985) differentiates the determinants into three groups according to:

- Personal characteristics and lifestyle habits of an individual (for example, past experience of participation in PA, enjoyment, age, perceived physical competence, smoking habits, self-motivation etc.).
- Environmental parameters (perceived available time, social support, accessibility of facilities etc.).
- Characteristics of the activity performed (intensity, costs etc.).

All of the mentioned factors have an impact on the level of PA, whether it is direct or indirect influence through mediators. According to Sallis and Owen (1999) the strongest associations are shown between adults' involvement in PA and such determinants as socioeconomic status and perceived self-efficacy. The weakest (or nonexistent) connections are found with behavioral attributes and skills, physical environment, and sociocultural factors.

Determinants and barriers of PA are certainly interconnected and it is important not to forget the cultural specifics underlying them (Crespo, Smit, Andersen, Carter-Pokras, & Ainsworth, 2000). Awareness and understanding of these

concepts help explain the possible effectiveness of intervention programs designed to increase PA in specific groups.

2.2. Physical activity and transitions in life

When doing research or conducting interventions in the field of PA it has become increasingly apparent that it is important to focus on the genders separately. As more research began to focus on barriers to activity rather than sedentary behaviors, (Dietz, 1996) marked differences in barriers for men and women arose. Likewise, unique benefits for PA among women, notably in dealing with breast cancer recovery, postpartum experiences, and health during pregnancy, require interventions that generally exclude men as a target group.

Additionally, many life transitions, such as marriage, having the first child, and introduction of elder dependents, are shown to affect women's' PA significantly more than men's' PA. On a societal level these gender differences, in PA, PA research, and PA interventions, may manifest in direct and indirect effects on health and well-being for women.

There are various transitions in life that normally involve major personal change. During such times reorganizing priorities, changes in demands on time, and high levels of stress can result in changes of health-related behaviors like PA or exercise. Transitions from childhood into adolescence and late-adolescence into adulthood had a serious effect on disease risks for the entire life span (Williams, Holmbeck, & Greenley, 2002). Research on marriage shows conflicting findings with loss of PA, most likely due to new responsibilities, as well as PA gains, most likely due to improved social support. Overall marriage was shown to significantly affect PA (Hull et al., 2010). However, there are studies that found strong positive and negative connections between the level of PA and marital status (King et al., 1998; Trost, Owen, Bauman, Sallis, & Brown, 2002). These findings emphasized the importance of future research on transition to marriage.

2.2.1. Transition to motherhood

Research on the transition to motherhood in women is abundant, and the results of interventions are promising, especially on psychosocial variables, and is detailed in the section below. The transition to parenthood has a significant decrease on PA for both men and women (Hull et al., 2010). However, quantitative studies can

be problematic since women sometimes reveal insignificant reductions compared to men as their initial PA levels tend to be lower prenatally (Hull et al., 2010; Pereira et al., 2007). Additionally when looking at inactive women, they tend to drop from nearly no PA to even less, a statistically insignificant amount. Still some success in identifying barriers postpartum revealed that childcare was a notable barrier for sedentary mothers (Hull et al., 2010; Pereira et al., 2007). Employment during pregnancy without reducing time spent working postpartum also posed a barrier to sufficient PA (Pereira et al., 2007). Having subsequent children reduced PA in mothers nearly the same amount as having first children, and mothers whose PA decreased did not recover that PA in the postpartum year (Hull et al., 2010). However, due to the problematic variables present in quantitative measures of mothers' prenatal and postpartum PA, qualitative studies have helped immensely in clarifying why some women remain inactive while others recover to pre-pregnancy levels of PA.

A qualitative study by Devine, Bove, and Olson (2000) uncovered three trajectories among women that show higher risk for retaining weight from pre-pregnancy through the first postpartum year: those with long histories of weight gain, those who participate often in structured exercise, and those who experience several life transitions at once/ high levels of postpartum stress. Mothers who primarily exercised in structured settings prenatally were more impinged by the time constraints placed on them by motherhood, whereas LPA adherents recovered their previous PA levels by six months postpartum, highlighting the importance of LPAI (Devine, Bove, & Olson, 2000). Many participating mothers identified LPA as an important factor during the prenatal and postpartum year for maintaining their PA.

Surprisingly, weight orientations were shown to persist strongly through the first postpartum year (Devine, Bove, & Olson, 2000). This revealed that the factors underlying PA, notably the barriers posed by such things as socio-economic status, social support, education level, and knowledge of PA, can be stronger limiters of PA in the long term than the introduction of a newborn. Therefore, it is particularly important to understand the orientations towards diet and PA preexisting in mothers with newborns so that any postpartum intervention can be personalized to fit their situation. Depending on PA trajectory, the largest barrier to exercise for mothers with newborns could vary between knowledge and competence, daily stress level, other major life transitions, or resources and social support (Devine, Bove, & Olson, 2000).

2.2.2. Transition to employment

Finishing studies and moving into paid work reduced levels of PA in both men and women (Bell & Lee, 2006). This is mainly seen as a younger transition, and so there are complications with the normal trends of PA loss that are seen with aging from pre-teen to adolescent and adolescent to adult. The most likely barriers that arise during this period are loss of free time to dedicate towards leisure time PA, a more demanding schedule that reduces lifestyle PA, and loss of access to recreational areas (Bell & Lee, 2006). Barriers that are uncommon in this transition, most likely due to the young age, are multiple-transitions, caregiving, and marriage. However, women that did transition to early motherhood during this time period were more likely to be socially disadvantaged and lead unhealthy lifestyles, including lack of PA (Bell & Lee, 2006).

Women who go through transitions such as beginning paid work, or having a first child are less likely to be active afterwards. Therefore, it is important to craft PA interventions that are more conducive to the type of PA for women going through these transitions, whether it is incorporated into LPA or leisure time exercise (Brown, 2003).

The problem of physical inactivity and the prevalence of sedentary behaviors among certain groups of people cannot be underestimated. There is abundance of research on benefits of PA and negative influence of inactivity on physical and psychological well-being. The motives for being physically active and possible barriers to exercising are widely discussed in research and practice. However, there is still a gap between the theoretical knowledge and practical application of effective interventions that could make people more physically active. There is a need to develop effective interventions for the specific population groups that are usually left out of scope. The present section covers the most important concepts and existing research in the area of physical inactivity among specific population group, women in transitional phases of their lives.

3. AIM

The aim of current research is to examine the change in PA and sedentary behavior for two groups of stay-at-home and working mothers from Finland after a one-year, group-based LPAI.

In detail the aims were to:

3.1 Study whether there are changes in LPA and sedentary behaviors as measured by accelerometers.

3.2 Study whether there are changes to LPA and sedentary behaviors as measured by HETUS.

3.3 Study the direction of the possible changes in LPA.

4. METHODOLOGY

4.1. Participants

The participants in this study were two groups of eight and seven mothers with newborns living in or around a central Finnish city [A], and one group of eight working mothers with newborns or slightly older infants living in or around a separate central Finnish city [B]. Initially there were eight members in the group from city [A] but one member dropped out in the middle of the intervention. The mothers from city [A] were between the ages of 28 to 41 and the mothers from city [B] were between the ages of 29 to 42. Recruitment was done through magazine advertisement. The overall criteria to ensure inactivity within the groups was to have been physically active zero to three days in one week with a physically active day containing at least thirty minutes of health enhancing PA. The city [A] groups were required to have a child of less than one year of age at the start of the study and to be a stay at home caregiver. The city [B] group was required to have full time employment and young children or toddlers. All participants had between one and six children. By the end of the intervention all mothers but one from city [A] had returned to work, and city [B] mothers six mothers started working. Three mothers from city [A] did not complete the post-test measurements as of the completion of this thesis.

4.2. Design

A pre- and post-intervention non-randomized test design with no control group was used for this study. Participants' pre-intervention activity or sedentary levels were measured via accelerometers and time use surveys. The intervention followed and included a meeting once per month for twelve months to discuss PA. A three-week period of activity monitoring using a Polar Heart Rate monitor was included during the first trimester of the intervention. Afterwards another data collection using accelerometers and time use surveys was performed to ascertain current sedentary or activity levels.

4.3. Measures

4.3.1. Harmonized European time use survey (HETUS)

Time use surveys were used as a main tool in the current research, a version of HETUS modified for the Finnish language (Eurostat, 2008) (see Appendix A). This self-administered tool collects data in 10-minute intervals from 6:00 to 22:30. The time use survey has four columns and requests information on primary activity, secondary activity, location, and who the activity was done with. The first three columns are filled using the participants own words and the last column is filled in using a provided code(s) representing: alone, children, spouse, mom and/or dad, siblings and/or relatives, other moms and/or dads, childhood friends, Facebook™ friends, and others.

The answers were coded according to the guidelines presented by Eurostat in their report "Harmonized European time use surveys." Primary and secondary activity includes codes such as: 021 Eating, 111 Working time in main and second job, 121 Lunch break, 910 Travel to or from work, 611 Walking and hiking, etc. With whom the time was spent includes: 1 Alone, 2 Children, 3 Partner, 4 Parent(s), 5 Siblings or other relatives, 6 Other parent(s), 7 Childhood or lifelong friends, 8 Facebook™ friends, 9 Others. Location and transport mode includes among others: 11 Home, 15 Restaurant, cafe or pub, 22 Travelling by bicycle, etc. A binary code was also used to assess whether the participants were using a computer or the internet during their activities with 0 signifying not used and 1 signifying used. After completing the time use survey a short questionnaire at the end inquired whether the day was representative or exceptional and if they would classify it as busy or not.

4.3.2. ActiGraph GT3X and GT1M accelerometers

ActiGraph GT3X and GT1M accelerometers were used in this study. These accelerometers are designed as an objective tool to measure PA. They are small, light and worn on the waist. The model GT3X can measure acceleration along three axes to a sensitivity between 0.05 to 2.5 G's at a rate of up to 30 times per second. The model GT1M can measure vertical acceleration which is sufficient for this particular study and has a sensitivity between 0.05 to 2.0 G's. An internal digital filter selects data along the human movement frequencies and it is summed over a user-defined epoch which was 60 seconds in the present research. The device is fully enclosed with no

readout and is connected to a computer using USB 2.0 cable. The data is downloaded and analyzed with the ActiLife software package provided by the manufacturer. The data from the accelerometer comes as raw movement counts (Welk, 2002). Counts of less than 100 counts-per-minute are defined as incidental PA, which is non-purposeful PA occurring along with everyday activities. Light PA is defined in a span from 100 to 1951 counts per minute, moderate PA from 1952 to 5724 counts and vigorous PA as more than 5725 counts (Freedson, Melanson & Sirard, 1998).

4.4. Procedure

Stay-at-home mothers wore accelerometers from seven to nine days in February and the working mothers in March from eight to twelve days with instructions to remove it while sleeping, showering or swimming but to otherwise have it activated.

For three days during the data collection period while wearing the accelerometer participants were asked to complete a modified HETUS and requested to include two weekdays and one weekend. The participants were instructed to fill in each box using concise descriptions of their own choosing, except for the 'with whom the time was spent' column which had multiple choices provided.

Following the initial data collection mothers participated in a twelve-month intervention supervised by Esa Rovio and Pinja E. Laitinen with assistance from Liisa Lautamatti. Once per month the mothers assembled as a group with a moderator from LIKES Foundation for Sport and Health Sciences who led a workshop-style social and educational discussion about PA and together explored the barriers to PA faced by members of the group (Laitinen, 2012). The topics covered included: time use, social relationships, goal-setting, barriers to PA, and motivations for PA. A typical session began with administrative details before moving on to a small-group discussion, usually in the form of an assignment, on the main theme of the month. Next, the participants came together to discuss as a large group and then went on a 30 to 45 minute walk through the forest and continued their discussions. Following that, the second half consisted of another small-group assignment and large-group discussion. Participants spoke of their current feelings and thoughts during the session (Laitinen, 2012).

Throughout the entire process moderators solicited the preferences from the participants on choice of topics, content of the sessions, and methods to reach the

desired goals. Feedback was incorporated into the intervention, and a full description can be found in “Mothers of newborns searching for connection to physical activity: An action-research intervention study” by Pinja E. Laitinen (2012). Part of the workshops also included a review of the mothers’ pre-assessment tests, when they were provided with a summary of both the accelerometer and the HETUS datum. Additionally, during a three week period in the intervention the groups were issued Polar Active™ as a PA awareness tool.

At the end of the intervention participants again wore the accelerometers for approximately ten days in February and March 2012 and completed a HETUS for two weekdays and one weekend. All but one of the stay-at-home mothers had returned to work by the second measurement. Data was collected by LIKES. The HETUS data was coded and assimilated, and raw accelerometer data was processed using ActiLife™ software for daily-step-count, minutes spent doing light, medium, heavy, very heavy, and health-enhancing PA.

4.5. Analysis

The accelerometer data was entered directly into SPSS. The time use survey data was coded and each activity code was assigned a metabolic equivalency intensity level (MET). Three codes were chosen to represent significant levels of activity for the participants. Level one represented sedentary behaviors. Level two represented various forms of light PA. Level three represented PA level at or above a brisk walking pace. The updated compendium of physical activity by Ainsworth et al. (2000) was used to assign activity codes to the MET range. The values represented on Ainsworth’s scale are seen in Table 1.

Table 1. PA levels with corresponding MET values

PA level	MET value
1	< 3.0
2	3.0 – 4.6
3	> 4.7

Duplicate tests were used on both sets of data. Due to small sample sizes, non-normal distributions, and high variance within groups, non-parametric tests were used to analyze the data. A Wilcoxon signed rank test was performed to determine whether

there was an increase in PA across all participants from pre-intervention (Time one) to post-intervention (Time two) measurements. Then a Kruskal-Wallis test was performed to investigate significant changes based on group and number of children (one, two, or three children). Significant results were analyzed *post hoc* in pairwise comparisons using a Mann-Whitney U test with Bonferroni corrected alpha values. The SPSS version was 19.0.0 for Windows™ and Macintosh™.

5. RESULTS

5.1. Harmonized European time use survey

A Wilcoxon signed rank test was performed to determine if PA changed overall from Time one to Time two. The mean change (M = 0.03, SD = 0.13, N = 18) was not significantly greater than zero, z = -.742, p = .458 with a small effect size (r = .11). The mothers' PA did not change during the invervention year from Time one to Time two.

A Kruskal-Wallis test was used to reveal significant differences in PA at Time one and Time two separately between intervention groups and between groups based on number of children. There was a statistically significant difference found in MET values at Time one when separating by interventions groups, χ^2 (2, N = 23) = 11.579, p = .003, but no difference at Time two. No difference was revealed when separating based on number of children. Descriptive statistics of the HETUS sample divided by intervention group and then number of children are presented below in Table 2 and Table 3.

Table 2. Descriptive statistics of HETUS PA based on intervention group

Group	Time 1			Time 2		
	N	Mean	SD	N	Mean	SD
1[b]	8	1.28	.052	7	1.32	.074
2[a]	7	1.45	.059	4	1.34	.059
3[a]	8	1.47	.086	7	1.43	.124

a = intervention group from city [A], stay-at-home mothers at Time 1

b = intervention group from city [B], working mothers both at Time 1 and 2

Table 3. Descriptive statistics of HETUS PA based on number of children

Number of Children	Time 1			Time 2		
	N	Mean	SD	N	Mean	SD
1	7	1.46	.115	6	1.37	.090
2	8	1.36	.081	7	1.33	.161
3	6	1.37	.100	4	1.31	.081

Next, a *post hoc* Mann-Whitney U test was conducted using Bonferroni adjusted alpha levels ($p = .017$) to test significance between groups. It confirmed that, at the start of the intervention, working mothers were less active than the stay-at-home mothers. There was no difference found at Time two.

5.2. Accelerometer

A Wilcoxon signed rank test was performed on each intensity level of accelerometer output to determine if there was any change of PA during the intervention. Light activity from Time one (M = 322.9, SD = 57.1, N = 20) to Time two (M = 290.0, SD = 53.5, N = 20) was the only level of activity with significant difference, z = -2.501, two-tailed p = .012, with a moderate effect size (r = .40). Mothers recorded less light activity via accelerometers after the intervention than they did before the intervention.

Next, a Kruskal-Wallis Test was used to reveal any significant differences in PA between intervention groups and between groups associated with number of children in light activity. For descriptive statistics on these groups see Table 4 and Table 5.

Table 4. Descriptive statistics of accel. light PA based on intervention group

Group	Time 1			Time 2		
	N	Mean	SD	N	Mean	SD
1[b]	7	300	32.4	7	274	47.8
2[a]	5	394	65.6	5	298	42.4
3[a]	8	315	53.8	8	299	66.0

a = intervention group from city [A], stay-at-home mothers at Time 1

b = intervention group from city [B], working mothers both at Time 1 and 2

Table 5. Descriptive statistics of accel. light PA based on number of children

Number of Children	Time 1			Time 2		
	N	Mean	SD	N	Mean	SD
1	7	312	49.6	7	264	52.4
2	7	316	69.7	7	289	56.0
3	5	343	51.1	5	288	59.3

There was no statistically significant difference in light activity between intervention groups, χ^2 (2, N = 20) = 3.694, p = .158. Unlike HETUS results, the accelerometer results did not show working mothers performing less PA than non-working mothers before the intervention. The accelerometer results based on number

of children aligned with the HETUS results, the Kruskal-Wallis test did not reveal any significant differences at Time one, $\chi^2(2, n = 18) = 1.572$, $p = .456$, or at Time two, $\chi^2(2, n = 18) = .454$, $p = .797$.

6. DISCUSSION

The purpose of our current research was to examine if there was change in PA and sedentary behavior for two groups of stay-at-home and working mothers from Finland after a one-year, group-based LPAI. Statistical analysis of pre- and post-intervention data from time use surveys and accelerometer outputs was completed for these three groups of Finnish mothers. No significant results were obtained when comparing pre- and post-intervention assigned MET scores, derived from the time-use survey, among the three groups. This means that no change was detected in the level of PA or sedentarism after the intervention between groups. However, a significant difference between the pre-intervention measures was found: women from group one, who were initially working, were significantly less active at Time one than mothers from groups two and three, who were initially staying at home. Employment is proven to reduce levels of PA among young adults and increase the prevalence of sedentary behaviors (Bell & Lee, 2006), which explains the fact that the working mothers were less active than the stay-at-home mothers. Regardless, women who were already working at the start of the intervention did not show any significant changes in the level of PA after the intervention.

The analysis of accelerometer data revealed a significant difference between pre- and post-intervention measurements overall. The Wilcoxon signed rank test showed a moderate decrease in light PA from pre-intervention measurements to post-intervention measurements. However, the *post hoc* analysis of groups did not reveal any significant changes from Time one to Time two. The overall decrease in light PA from pre- to post-intervention measurements can be attributed to the fact that all women from city [A] were still working and six women from city [B] started working before the post-measurement, which has an impact on the use of time (Bell & Lee, 2006).

Concerning the pre-intervention measurements, there were no significant differences in pre-intervention data between the three study groups found. However, the median scores for working mothers were lower than those of who were not working when the intervention began. The median scores show consistency with those of time use survey, but are not statistically significant, possibly due to small sample size.

All in all no significant change in levels of PA and sedentary behavior after the intervention could be detected in the current study. One possible explanation is the fact that some mothers started to work or returned to employment prior to the post-intervention measurements, which, as mentioned above, could have a lowering effect on overall level of PA. In this case the fact that the level of PA did not strongly decrease during the intervention is a good indication that the intervention might have had an effect on the level of PA after all. Literature claims that there are standard tendencies among postpartum women that show large declines in PA level (Devine, Bove, & Olson, 2000; Zourladani, Tsaloglidou, & Tzetzis, 2011; Pereira et al., 2007), but our research did not confirm any large decrease in the level of PA. Moreover, the participants gave positive feedback on the intervention, showed high interest in it and only one participant dropped out (Laitinen, 2012). These facts are providing valuable information for developing future interventions for mothers.

6.1. Limitations and strengths

However, there are a number of limitations to the study that lower its statistical significance:

1. The research design lacks a control group. Comparison of the groups, which were subject to intervention, with a control group could help in establishing the possible impact of the intervention on the level of PA and sedentarism.
2. The sample size was relatively small ($N = 23$) so the within-group comparisons most likely could not provide any significant pre- and post-intervention differences in test results for a larger population. By increasing the overall sample size more reliable results could be obtained.
3. The methods of collection of pre- and post-intervention data in this study were initially meant to serve as feedback to the participants of the intervention. Though the combination of the objective and subjective methods is described as optimal in relevant literature (Hart, Ainsworth, & Tudor-Locke, 2011) it might be beneficial to use different or additional methods or approach the choice of methodology in a more creative way in the future. One of the suggestions might be to adjust the time use survey for registering PA and sedentary behaviors specifically and to check the consistency between the instruments' measurements.

4. Three technical issues occurred with the accelerometers during the post-measurments. One participant broke a leg and was not able to measure her PA via accelerometer, one accelerometer was lost in the mail, and one accelerometer was broken. Additionally, seven participants of the study reported that the accelerometers did not measure several activities such as: group exercise (one hour), shoveling snow (30 minutes), cross-country skiing (three hours and two hours for different participants), spinning class (45 minutes), ice-skating (one hour), home exercise with kettle bells and balancing board (30 minutes), pool exercise (one hour 15 minutes), swimming (one hour) and downhill skiing (four hours 30 minutes). Also situations such as sudden sicknesses, moving, exam times and new pregnancies affected the post-measurements in that the days they were worn did not reflect the typical PA level for the women. Considering the small sample size, these measurement limitations might have had an effect on the results and should be dealt with in future research.
5. The intervention primarily targeted psychological variables such as attitude and knowledge towards LPA and social support. However, the measurements tested only behavioral variables. More significant results may have been obtained if attitude toward LPA or social support for PA had been investigated using appropriate instruments.

The strengths of this study, despite all the limitations, cannot be underestimated. This research in itself is unique because it targets a specific group of *sedentary* individuals that had not been studied before in the context of LPAI. The current study summarizes the problems and knowledge gaps existing in the areas of sedentary behaviors and motivation for PA, gender issues in the context of development of the relevant interventions, and need for research of effectiveness of interventions in specific populations such as mothers with newborns going through life transitions. The study analyzes the possible changes in PA after applying an LPAI to several groups of Finnish mothers and reveals an absence of change, which is in itself an optimistic start for future research.

6.2. Ethical considerations

The participants of this study gave their consent to LIKES for the handling of their confidential information and use of the study data. During the study the participants were issued summaries of their measurements to dicuss in a group setting and were free to share their concerns and feedback about the measurements and limitations. This measurement-feedback led to the redaction of one set of datum from the accelerometers due to an inaccurate representation of what had actually occurred during that day. It was the LIKES researchers' belief that trusting the participants versus the instrument was the correct approach in this situation, where participants were engaged in highly reflective PA measurement and had some practice in evaluating their PA via HETUS coordinated with accelerometers.

Data from LIKES was handled exclusively by the researchers and kept in a secure location otherwise. Electronic data files were exchanged using a secure online data-box system. The paper files were returned to the LIKES project and the electronic data files will be held by the researchers until the thesis processing is complete. All data has been treated as confidential and no names or locations were used that could compromise the identity of participants in the study.

6.3. Implications for future research

For future research it is important to eliminate the existing limitations, mentioned above. In other words, the following alterations should be made. First of all, the sample size has to be increased in order for the results to possibly become more significant. Then a control group should be included to reveal any causal relationship between the intervention and the level of PA. Finally, appropriate measures have to be chosen to match the aims of the intervention. To be able to understand if an intervention has any long-term effect the follow-up measurements have to be done to see if the level of PA is maintained after the intervention (after one year, two years, five years, ten years). It is especially important for interventions that take place in the transitional phases of life, because it is more difficult to adhere to specific behavior patterns.

There is a need for developing effective PA interventions for specific population groups (such as women in transitional phases of their life) in the interest of

health promotion. Thus appropriate studies of effectiveness of those interventions are an area for future research development.

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APPENDICES

Appendix A

Päiväkirja ajankäytöstä (kaksi viikonpäivää ja yksi viikonlopun päivä)				
Aika	**Mitä tein?** Merkitse pääasiallinen toimintasi 10 minuutin tarkkuudella	**Mitä muuta tein?** Merkitse tärkein saman-aikainen toimintasi	**Missä olin?** Kerro paikka, jossa olit esim. kotona, puistossa, kaupassa, kävelemässä, autossa jne.	**Kenen kanssa olit?***
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00:20-00:30		**Kenen kanssa olit?**		
00:30-00:40		Olitko yksin vai yhdessä jonkun kanssa, jonka tunnet		
00:40-00:50		Merkitse sarakkeeseen numero 1, 2, …7 jne.		
00:50-01:00		1) Lapsen/lasten kanssa		
…		2) Avio/avopuolison kanssa		
…		3) Äidin tai isän kanssa		
…		4) Sisarusten tai muiden sukulaisten kanssa		
…		5) Muiden äitien/isien kanssa		
		7) Lapsuuden aikaisen ystävän / ystävien elämän varrelta		
		8) Facebook -kavereiden (tai vastaavien)		
		9) Muiden kanssa, jotka tunnen		